and heterozygous females. In appearance and behavior, therefore these flies could not be distinguished from normal full-eyed males and heterozygous females.

The possibility that the flies were due to contamination is not absolutely excluded, but the probability is very low. In handling food and flies the usual precautions were used. No larvae or flies appeared in the food jars. Both vestigial-winged and long-winged races were handled, but no contamination of one with the other appeared. Three full-eyed males and one heterozygous female appeared in the vestigial race and all had vestigial wings; the others appeared in the long-winged race, and all had long wings. The fact that all females were heterozygous is a very strong argument against the probability of contamination. In case of contamination the females should, at least in the majority of cases, have been full-eyed; but no full-eyed females appeared. In the face of this evidence it is almost necessary to conclude that these flies appeared by reverse mutation and not by contamination.

The appearance of such reverse mutations can not readily be explained on the basis of the presence and absence theory nor on the theory of association and disjunction, but it is not difficult to explain on the theory of chemical change. If a chemical change in the constitution of some substance, probably in the chromosomes, produced the bar-eyed mutant, then a reversion of that chemical change would produce the original substance and so bring about the reappearance of the original character, the full eye.

The data upon which this report is based together with a more detailed discussion will be published in the near future in the report on the selection experiments.

THE PART PLAYED BY ALCYONARIA IN THE FORMATION OF SOME PACIFIC CORAL REEFS

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Communicated by A. G. Mayer, June 22, 1917

Following up my studies on the coral reefs of the Tortugas Islands, in which it was found that in this particular region the alcyonaria contribute more limestone to the reefs in a given time than do the stony corals, a similar study of the coral reefs was undertaken, under the auspices of the Carnegie Institution of Washington, at the Island of Tutuila, American Samoa.

All of the coral reefs about Tutuila are fringing reefs, with the exception of the large reef at Nueli (Blacks Bay on the charts), which appears to be changing from a fringing into a barrier reef. Along most of the north shore the reefs are restricted to the bays, or harbors, while on the south side of the island the reefs are continuous from bay to bay around many of the headlands.

In Pago Pago harbor, which is bordered with coral reefs broken only where one of the numerous streams has its entrance, there exists all of the possible conditions of reef environment varying from those at the entrance of the harbor where the surf beats incessantly to those at its inner end where, even in severe storms, the water is only slightly agitated. Marked gradations in the salinity of the water and in the amount of sediment which it bears are also found at different points within this area so that the relationship of reef building organisms to these factors can be readily observed.

Six species only of alcyonaria were found on the reefs at Tutuila. Of this number two occur so rarely that they are unimportant factors as reef builders. All six species belong to the *Alcyonaceae.*

Two of the more abundant species contribute to reef formation only through the setting free of their spicules at the death of the colony. The others, *Alcyoneum rigidum* and *A. confertum*, form at the base of the colony a corallium-like mass of limestone composed of closely cemented spicules, upon which the living tissues are bourn. This rock is continuously added to as the colony grows outward and upward, the living tissues disintegrating about its base as expansion takes place. In this way heads composed of spicule rock are formed which extend to a height of 4 feet (up to low tide mark) above the general reef flat, and which have a circumference as great as 20 feet.

The distribution of the alcyonaria on the Pago Pago reefs depends on a number of factors. Very few specimens are found on the horizontal surfaces of the exposed reefs. On the nearly vertical faces of these reefs, however, *Alcyonium rigidum* often covers large areas forming a nearly continuous carpet. This species occurs on the faces and in the deeper holes of practically all of the reefs about Tutuila, but on the horizontal surfaces of only those reefs which while protected from heavy breakers, are traversed by strong currents which provide for good aeration, normal temperature of the water and against the silting up of the colonies.

A. confertum, which is next in importance as a reef builder, is the most resistant of the four species and is consequently the most widely distributed.

A. glaucum requires much the same environmental conditions as *A.*

rigidum but is commonly found in slightly less favorable conditions than the latter by which it is, on account of its habits of growth, easily crowded from the most favorable locations.

The fourth species *A. flexilae* is by far the most delicately branched and is also incapable of retracting its branches. It is consequently restricted to very quiet waters in the most protected locations on the reefs.

To determine the proportion of alcyonaria in different locations on the Pago Pago reefs clearly marked lines were run across a number of the reefs from the shore to their outer edges. Along these lines squares 25 feet on a side were laid off and the area occupied by alcyonaria esti-

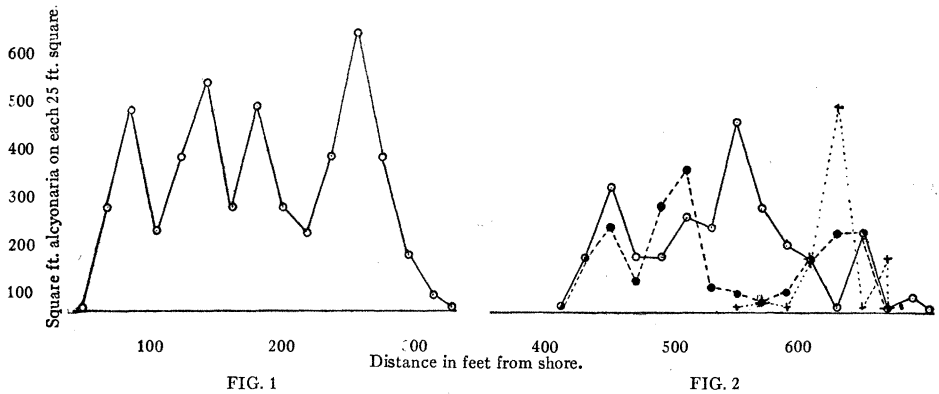

FIG. 1 FIG. 2

FIG. 1. Showing the distribution of the alcyonaria across the Utelei reef Pago Pago harbor, Samoa. The figures along the ordinate represent the distance in feet from shore, those along the abscissa the area in square feet covered by alcyonaria on each square the sides of which were 25 feet in length.

FIG. 2. Showing the distribution of three species of alcyonaria along a line the total alcyonaria of which is shown in figure 1.

Distribution as shown in the previous figure. Alcyonium glaucum, o————; Alcyonium confertum, ● – – – –; Alcyonium rigidum, + ...

mated for each square. Figure 1 shows the conditions on a reef along the south side of a cove at Utellei village which is situated on the west side of Pago Pago harbor about three-quarters of a mile from its entrance.

On account of the configuration of the shore line at this place a strong current sets across the reef area traversed by the outer half of this line, while over the inner portion the currents are very weak. The depth at extreme low tide varies from 6 to 15 inches over all of this reef except the lithothamnuium ridge which is exposed for a width of from 50 to 75 feet.

Figure 2 shows the area occupied by each one of the three species occurring along this line. The thickness of the rock formed from spicules

over these areas varies from a mere veneer to at least 2 feet. Along the outer vertical face of the reef on the opposite (north) side of this same cove many barren areas were found to be covered with a surface layer of spicule rock from 1 to 12 inches in thickness. This layer extends back into many subterranean caverns in the reef for a distance of several feet, and when added to the area of the reef face now covered with living alcyonaria constitutes an almost complete covering of spicule rock over the entire reef face for more than one-third of a mile from the head of the cove.

While these observations have made it clear that on certain of the pacific reefs the alcyonaria are important coral forming agents their relative importance can be determined only after borings have been made through some reefs to determine whether or not the present conditions are transient or have been maintained over long periods during the upbuilding of the reefs.

OBSERVATIONS UPON THE ALKALINITY OF THE SURFACE WATER OF THE TROPICAL PACIFIC

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Communicated, June 22, 1917

On a voyage from San Francisco, California, to Honolulu and thence to Pago Pago, Samoa; and also upon the return over the same route, we made daily observations of the hydrogen-ion concentration of the surface water, using for this purpose a set of thymolsulphonephthalein tubes standardized and prepared by Prof. J. F. McClendon, and kindly presented to us for this purpose.

It was found that in the mid-Pacific, N.N.E. of Samoa, the surface water at or near the equator was cooler, and less alkaline than 5°–10° north or south of this region. This fact will appear upon inspection of the tables at the end of this paper. It seems that the water of the equator at 24°.9 C. is so low in alkalinity as to be comparable in this respect with the water of only 15°C. about 300 miles off the mouth of San Francisco Harbor, California.

The low alkalinity of the water near the equator was usually although not invariably associated with a decided easterly set opposite in direction to the prevailing westerly surface drift of the tropical Pacific.

This suggests that counter currents at the surface in the tropical Pacific may be regions wherein the cold bottom water is rising to the surface; and that this cold water has not yet had time to come into